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-USSR-

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1. Features of Measuring Cost in Capital Construction

The constant and regular lowering of production costs is an objective necessity for the development of the Socialist economy, for cost decrease expresses the economics both of present and past labor. As a result of this it forms the basic source for the increase of public wealth and is an extremely important qualitative index characterizing the effectiveness of the operations of various enterprises, organizations and reflecting the results of all of their economic activities. The level of production cost in capital construction is influenced, for example, by economical decisions for buildings and other structures, the use of inexpensive construction materials, cutting down on the time for construction, the level of work mechanization, work organization, etc. According to the directives of the 20th Party Congress, in the Sixth Five Year Plan industrial production costs must be lowered 17%, construction costs -- 7%, tractor operational costs -- 13%, railroad transfer -- 17% and retail trade distribution costs -- 17%. If one considers the grandiose scale upon which production is conducted at present, it becomes clear that decreasing production costs even by 1% saves millions and billions of rubles which can be used to fill other needs of the national economy. Savings of only one ruble from each square meter of housing, based on the volume planned for housing

construction in the Sixth Five Year Plan (205 mil.M^2) will save the state 205 million rubles which can be used to construct, for example, 140-150,000 sq.m of supplementary housing.

The great economic significance of lowering costs gives great importance to cost statistics. Statistics play a large role in the battle to lower cost. It checks plan fulfillment on cost decrease, analyzes the reasons for under-fulfillment and over-fulfillment of plan and in this manner discovers reserves for further cost decreases. Recently, as a result of constant care by the Party and government, definite success was achieved in the matter of lowering construction costs. However, these results are to a great extent the result of lowering wholesale prices for construction material, transportation costs and electricity, and, to some extent, the elimination of excesses in planning. All of this has led to a decrease in estimated construction costs. The task of capital construction workers consists in lowering construction costs in comparison with the estimated costs. At present there are many defects in this area and tasks for decreasing construction costs are still not being fulfilled. Actual expenditures for construction projects in many cases exceed not only the planned but the estimated cost of these projects. During the years of the First Five Year Plan, construction organizations allowed losses amounting to 9 billion rubles. All of this testifies to the fact that in the area of construction the battle to lower cost is proceeding in a far from satisfactory manner. In order to eliminate present defects and to fulfill the new task provided by the Resolutions of the 20th Party Congress for the Sixth Five Year Plan -- to lower construction costs for the Five Year Plan no less than 7% -- it is necessary to improve construction basically and to take the necessary measures which will aid in lowering construction costs. A study of production costs in each branch of the economy has its own specific features. Modes and methods of cost statistics in capital construction also differ from the methods used in other branches of statistics, in particular, in industrial statistics. These basic methods proceed from the peculiar features which are characteristic for capital construction and distinguish it from industry. One of the basic and most important features of capital construction production is its individual, rarely repeated nature. From this proceed several important principles of capital construction cost statistics.

Two things are characteristic for industrial production and these are the following: in industry, in the first place, production of comparable products takes place to a

great extent and, in the second place, their production takes place basically under relatively identical conditions. On the other hand, in capital construction, both the production at various times is usually dissimilar as well as the conditions of production. For example, it is impossible to compare the cost of constructing various buildings and other structures built in two different years (according to designation, volume, constituent elements, materials used, etc.). Various types of construction work at various installations or in various years also do not necessarily repeat themselves; if they do repeat, they can differ in production conditions. Therefore, expenditures for construction during any one period cannot be correctly compared with the actual expenditures in a preceding period. For example, it is incorrect to compare, in studying the dynamics of earth-moving costs, expenditures for these projects undertaken in various areas and at differing times. Therefore, in determining construction cost decrease one proceeds first of all not from a comparison of actual cost with planned or basic costs of comparative production as is done in industrial statistics, but by comparing the actual cost of construction with its estimated cost. The task of decreasing construction cost is established also not in comparison with the actual cost level of the preceding year, but in respect to estimated cost. Estimated cost should decrease in capital construction. Consequently, decreased construction costs always mean a decrease in actual costs in comparison with estimated costs. Therefore, in the future, when we speak of decreasing construction cost, we shall always have in mind a decrease in estimated cost. In capital construction cost statistics, alongside planned and actual indices, estimate indices also are of great significance. The individuality and unique nature of various types of capital construction signify not only its great variety (apartment house, railroad, industrial enterprise, bridge, etc.). Individuality and unique nature also signify that even installations which are identical in name differ from one another in certain features. From this proceeds another peculiar feature, which consists in the fact that it is impossible to establish identical selling prices such as for industrial production for individual types of finished installations (even for those of the same designation). The selling price for capital construction is determined on the basis of estimated calculations.

Another important characteristic of capital construction is the fact that construction possesses a lengthy production cycle. The production cycle in construction is, on the average, longer than in industry. It follows from this that a study of capital construction cost should be

conducted with other means, which are the following: 1) study of the finished products of capital construction (study of the cost of individual finished installations); 2) study of construction production cost (study of cost of construction carried out during any period, independent of the degree of completion of the individual units). A cost study not only of capital construction finished production, but its intermediate production (including incomplete production) is essential because, in the first place, only by this method is it possible to assure a current study of cost and, in the second place, is it possible to obtain comparable data for different construction jobs as well as for different organizations. Particular attention will be devoted in this chapter to these basic features from which ensue all specific methods of cost statistics in capital construction.

2. Cost and Price in Capital Construction. Role of Estimate in Planning and Calculation. Significance of Model Planning and Model Estimates

The characteristic feature of planning and statistics in capital construction is the fact that estimated cost lies at the basis of cost indices. In industry, if production of an individual nature is being conducted, that is, production on individual order which will not be repeated, a determination of the cost of these products and even acceptance of an order for them cannot be effected without preliminary calculation and without drawing up an individual estimate. The same holds true for capital construction. However, here the drawing up of plans and estimates is constantly an essential job, since as in industry, it embraces merely a small group of products. In capital construction the plan and estimate are the basis for a correct and successful carrying out of the job. Without plans it is impossible to organize correctly the production process, and without estimates it is impossible to conduct calculations and planning. The estimate is the starting point also for conducting cost accounting. Calculations on job fulfillment between customer and contractor organizations take place on the basis of estimated cost. The selling price of capital construction production is also determined on the basis of estimate. In view of the fact that the end product of capital construction possesses many various types of structures, materials used, etc., it is impossible to establish single sale prices for it. The role of the selling price is carried out by single estimate prices established for individual sections and elements of finished production (for individual construction elements and types of work) on the basis of established estimate norms of materials and wage expenditures, selling

prices for materials and shipping costs, as well as standards of overhead expenditures and planned accumulation. Instead of single selling prices for finished units, prices are established for their various elements, from which the cost of the units as a whole is later composed. The expenditure norms on the basis of which individual prices are formed are average quantities (for example, average work category, average amount of expended materials, etc.). Prices determining the cost of materials, etc., are similar average quantities. For example, prices for materials are established under conditions of average transportation distance, average relation between the various types of transport means, etc. On the basis of estimated expenditure and price index norms, estimated prices for units of construction elements and types of work are drawn up. Multiplying the volume of work completed by these estimated prices for units of work and construction elements, one arrives at the sum of direct expenditures for construction. If we add the sum of overhead expenses (according to established norms), we receive the sum of estimated job cost. Estimated job cost, together with the sum of planned accumulation, provides a complete estimated job cost. The sum of planned accumulations is determined according to established norms. Present planned accumulation norms are the following:

Types of Jobs	Norm Calculated	Planned Accumulation norm in %
Construction jobs	From direct expenditures	2.7
Erection of metal structures	-	1.0
Erection of metal span structures for railroad and highway bridges	-	1.0
Equipment mounting	From job cost	2.2
Marsh preparation jobs at peat enterprises	From direct expenditures	2.7
Capital underground jobs in mining	-	2.7

As can be seen, the sum of planned accumulation comprises merely an insignificant proportion of construction value (these norms will be even smaller in relation to value). It follows that construction value is close to its cost, closer than in industry, since in the first place, net income appears here only in the form of planned accumulation

(there is no turn-over tax), and in the second place, the very amount of planned accumulation is not great. Under the self-supporti method of operations the accumulation sum is not planned at all. In this case, construction value and cost coincide. Planned cost and planned value of a job are calculated on the basis of estimated cost. Planned cost of construction includes the sum of expenditures which are essential for carrying out these jobs under specific conditions and with consideration of the established task for decreasing cost for a given period of time and with consideration of savings on price decreases for materials and transportation costs. The job cost decrease task is established in annual plans in a percentage of the estimated job cost. The basis for this is the construction production estimate, which should not be confused with the construction estimate. The construction estimate, as indicated above, is drawn up for individual units, independent of the construction organizations building them, and independent of the time of job completion. A characteristic feature of these estimates is the fact that they are drawn up on the basis of average standard quantities. Contrary to this, the production estimate is drawn up by various construction organizations on the work volume which they are to put out during the course of the planned period. The results of these estimates are based on specific and local conditions of job fulfillment. With the aid of planned calculation norms of labor expenditure, materials expenditure, machinery-shift expenditure, electricity, etc., are determined. The basis of planned calculation is the work organizatiohn plan and the organizational-technical measures plan.

In view of the fact that construction cost decrease can be achieved not only due to organizational-technical measures assuring plan fulfillment for construction cost decrease, but due to factors independent of construction organization (for example, decrease in wholesale prices for construction materials, parts, etc.), these two factors are calculated independently in the production estimate. Savings from construction cost decrease against the estimate is a source of net income for construction organizations. Net income comprises the sum-total of planned accumulations and the sum-total of savings on construction cost decrease (due to organizational-technical measures). The planned net income sum is calculated by subtracting from the estimated cost to the customer in prices of the planned period (with consideration of price and transport cost changes) the planned actual work cost. If the construction organization does not fulfill the plan for decreasing construction cost, but allows construction costs to increase, the net income may be even less than the sum-total of planned

accumulation. The sum of actually expended cash funds for the production of a definite volume of construction work is called the actual cost of the work performed. It is possible to arrive at the actual decrease in construction cost if we subtract from the sum-total of actual expenditures the sum of the estimated cost -- according to the current estimated cost -- (with the sum of planned accumulation). The actual savings from production cost decrease can be obtained also by subtracting from the planned savings, the sum of over-expenditures against the planned cost of construction work. We must note that in studying construction cost, the volume of construction work fulfilled includes incomplete construction. In view of this it is necessary to go into more detail on determining the value of incomplete production. The value of completed work for various incomplete construction elements and types of work is determined according to the degree of completion and on the basis of their estimated value (without planned accumulation). If, for example, the estimated cost of any type of work is 32,000 rubles, and it is 65% completed (by the first of the accounting period), the value of the completed portion of the work would be 20,800 rubles (3200 x 0.65).

The value of construction work completed during a specific period does not coincide with the cash expended during the same period. The latter is usually greater than the former (as a result of an increase in the cash balance, materials on hand which have not yet been expended, etc.), but also can be lower (for example, as a result of plan overfulfillment on construction cost decrease, mobilization of internal resources -- size and changes of cash turn-over, etc.). Therefore, in determiningg the volume of work completed it is essential to delimit carefully those expenditures which are to be included in the volume of completed work and those which refer to a different period. A calculation of actual expenditures in capital construction is made for the construction job as a whole or for groups of similar jobs. Single-price estimates (as well as planned calculation) are drawn up according to individual construction elements and types of jobs. Calculation of actual expenditures on construction elements and types of jobs is difficult in practice, because it is impossible to distribute part of the actual expenditures among the various construction elements and types of jobs (for example, the majority of materials: lumber, sand, cement, etc.). The very organizational-technical measures assuring fulfillment of the task for lowering construction costs can also pertain simultaneously to several types of jobs, or to several types of construction elements. Therefore, calculation of actual expenditures is made for the construction

job as a whole -- according to individual expenditure items. Calculation of actual expenditures for individual construction elements and types of jobs is not assured by primary documentation.

Therefore, comparison of actual and estimated cost indices for individual construction elements and types of jobs is impossible, and this is a significant gap in the field of study and analysis of cost in capital construction. The cost of finished construction -- buildings and other structures, determined in the estimate documentation, is known by the name "construction cost." However, the ultimate cost of completed construction jobs includes the cost of preliminary planning and study pertaining to the various finished units. The estimated cost (under the contractor method of splitting up jobs) or the actual cost (with the cost accounting method of handling the job), with the addition of a suitable portion of the cost of preliminary planning and study and other preliminary work, is called the inventory cost. For this cost finished units are included in basic funds to the balance of the customer (or the same enterprise). Expenditures for preliminary planning and study either pertain to individual direct designation jobs, if these expenditures are for the construction of only one unit, or are distributed among the various units proportional to the estimated cost of the finished units, if these expenditures pertain to several units. The estimated cost for drawing up plans is determined according to a single price rate list for planning studies, established for all ministries and departments. The cost of other preparatory work includes two types of expenditures: expenditures connected with preparing the construction area (clearing of the site, preparation of the site, draining, etc.) and expenditures for maintaining management and technical supervision at the enterprises under construction. The size of these latter is determined by standards in dependance on the estimated construction cost of the given enterprises. These standards are presently the following:

Estimated Construction cost (in mil. rubles)	Management Maintenance Expenditure Standard (in %)
Less than 5	1.09
5-10	0.99
10-50	0.85
50-100	0.76
100-200	0.61
200-500	0.52
500 and more	0.38

Distribution of the actual cost of these other preparatory jobs among various units (if they pertain to various units) is done proportional to the estimated cost of the finished units. At present construction is done on a large scale. Mass production is unthinkable without standardization and typification. Therefore, one of the main tasks facing persons in architecture is the development of modern standardized plans for the construction of buildings and other structures. At present things are far from perfect in this area. Standardized plans for buildings and structures are not being used to a sufficient degree, nor are plans for standardized elements and structures. Repeated economic plans are little used, for example, in Moscow the volume of jobs carried out according to standarized plans in 1954 comprised only 18% of the total of housing and cultural-communal construction. Only in the last few years has standardization improved. In 1955 the volume of jobs completed from standardized plans increased in comparison with 1954 twofold. At present about 60% of all apartment houses are being built according to standardized plans.

However, standardized planning in industrial construction is still poorly developed. The volume of construction carried out according to standard plans in industrial construction comprised 7% in 1952, 12% in 1953. In 1954, for the construction of chemical industry enterprises, the volume of construction carried out with standard plans comprised 1% of the total volume, and for ferrous metallurgy -- 8%. Standardization of industrial enterprises is more difficult than for apartment houses, since their technological process as well as their equipment have individual features in almost every case. However, practice has shown that standardization can also be applied in industrial construction. The successes which were achieved in standardization and typification of individual elements and parts of industrial buildings and structures can serve as a basis for transition to standardization of industrial enterprise plans. The Party and the government consider standardization to be extremely important. In the directives of the 20th Party Congress for the Sixth Five Year Plan the task was announced to "complete in 1956-1957 the transition to construction of apartment houses and buildings of cultural-communal designation according to standard plans; to make the transition in the coming 2-3 years to the construction of industrial enterprises, transport, communications and agricuature, as a rule according to standard plans." (Direktivy XX s'yezda KPSS Po Shestomu Pyatiletnemu Planu Razvitiya Narodnogo Khozyastva SSSR na 1955-1960 Gody) (Directives of the 20th

Party Congress for the Sixth Five Year Plan for the Development of the Soviet Economy for 1955-1960", Gospolitizdat, 1956, p. 47)

Concrete tasks in construction on the basis of standard plans were given in the Resolution by the USSR Council of Ministers (24 August 1955, No. 1553). According to this Resolution, the volume of construction carried out according to standard plans (in a percentage of total volume of construction work) should be no less than 80% in 1955 for construction of enterprises, buildings and other structures of industry for the USSR Ministry of Construction, 90% for the construction of enterprises, buildings and other structures for agriculture for the USSR Ministry of Agriculture, etc. An important question connected with the use of construction sites is the selection of the number of floors for the various units. One should keep in mind that buildings with many stories have an advantage over buildings with few. In constructing buildings with many stories the proportionate weight (relative volume) of individual jobs decreases (job volume on foundations, roofs, etc.). The time is shortened which is necessary for preparatory work, and the volume of work for landscaping is decreased as well as operational expenses, and construction machinery use during construction time is improved, etc. Construction according to standard plans assures a broad application of industrial methods in construction, the application of prefabricated reinforced concrete, the use of large-block and large-panel construction, that is, creates all essential conditions for transforming the construction process into the assembly of prefabricated construction elements and parts. The basic index characterizing the degree of use of standard plans is the volume of construction according to standard plans to total volume. Besides this general index, each type of construction has specific indices. For example, for housing construction -- the number of standard buildings per sq. km, in transport construction -- the repetition of single-type buildings and other structures per 100 km of railroad track, etc. According to data of the Volga and Central Asia Glavzheldorstroy, for example, each 100 km of railroad track has 8 stations, 5 service buildings, 50 to 100 small bridges, and pipes, etc.

An important result of the use of standard plans is the possibility of changing to dual-stage planning. With dual-stage planning the cost of developing plans is decreased to a considerable extent. In addition, planning time decreases, a fact which makes it possible to improve the furnishing of planned-estimate documentation to construction jobs. Extension of the use of standard plans is an import-

ant condition for the improvement of planning and, in addition, construction as a whole.

3. Cost Structure of Individual Units and Completed Construction Jobs

In order to determine correctly the net cost (sebestoimost') and final cost (stoimost') of capital construction, as well as means of lowering it and, in addition, to uncover reserves and sources of savings, it is necessary to make a careful study of cost structure. Cost structure depends on the nature and composition of work (depending on labor consumption or material consumption), on the method of performing the jobs (mechanized or manual), on various seasonal factors, etc. At present the grouping of cost items in capital construction is made according to expenditure items. Total job cost is formed of two large groups of expenditures, which are the following: Direct expenditures and overhead expenses. The direct expenditure group includes expenditures directly connected with the construction process. This includes expenditures for construction materials, basic wages, expenditures on construction machinery operations and other direct expenditures. The overhead expenditures group includes expenditures connected with construction organization, management or servicing of production processes. Overhead expenditures include the following: administrative-executive expenditures, expenditures for workers' service facilities, expenditures for job organization and production and non-production expenditures. We shall examine carefully the various constituent elements of these expenditures. We shall begin with the direct expenditure group.

Construction material expenditures form an important part of direct expenditures. The cost of expended basic and auxiliary materials, semi-finished products, construction elements and structures comprises from 30 to 70% of the total cost of construction work. The cost of construction materials, parts, and semi-finished products includes payment for them according to established selling prices (with the exception of materials which are produced at subsidiary and auxiliary plants operating on the funds of the construction organization, since these materials are evaluated according to actual cost), the price increase of marketing and supply organizations, payment for packing, delivery of materials to the construction site and, finally, procurement-warehouse expenditures. The cost of materials means their f.o.b. prices at the construction shed, including procurement-warehouse expenditures. The latter includes expenditures for maintaining the pro-

curement apparatus and for operating warehouses, expenditures for preserving materials as well as the cost of the materials damaged en route and in the warehouses. The norm is established as a percentage of the cost of the materials. Expenses for transportation, delivery of materials to the work area (since they are not included in cost of materials) are included in the other separate items of direct expenditures (basic wages, expenditures for machinery operations, etc.).

Another important item of direct expenditures is basic wages for workers. This item includes all types of direct remuneration for the labor of basic production workers, that is workers engaged directly on construction jobs, on transporting materials from the warehouse to the place of work and on auxiliary jobs with construction machinery. This does not include the wages of workers who are engaged in subsidiary and auxiliary plants, in operating construction machinery (operator, motor-mechanic, mechanic, and others, since their wages are included in another item, in expenditures for machinery operations), for transportation of construction materials to the warehouse(the wages of these workers are included in the cost of the materials) and on jobs handled at the expense of overhead expenditures, for example, equipment of temporary, non-titled buildings and other structures, etc. The basic wage fund for the above-listed workers includes the following: remuneration for work completed (direct or progressive-piece rate system, as well as simple piece rate) or for time work (according to hourly wages), overtime and holiday pay, remuneration for work stoppages not due to the fault of the workers (with the exception of work stoppages due to weather -- remuneration for which is included in the supplementary wage item), payment for spoilage not due to the fault of the worker, supplementary payment to piece rate workers in connection with changed work conditions, additional payment for special(difficult and dangerous) work conditions and for work in distant areas; payment for apprentice training on the job, supplementary pay for workers handling jobs below their category and, finally, prizes (cash and in kind) and bonuses (based on the present system of bonus payment), besides single cash bonuses not provided by the permanent bonus system. The basic form of labor remuneration in construction is the piece rate wage. More than 90% of all wages are paid to piece rate workers. Remuneration of hourly rate workers (electricians and other workers doing maintenance work on construction machinery, and others) is made on the basis of base pay for the various categories, with an increase of the average percentage of norm over-fulfillment by the basic brigades if the

continuous machinery operations depended on their work. We should note that beginning with 1 January 1956, a new unified 7-category wage system was used in construction. The relation between the extreme wage coefficients of the new system are equal 1:2.8, while previously this relation was 1:2.42. The significance of this new unified system consists of the fact that it systemitizes the labor remuneration of construction workers, and, in addition, stimulates an increase in worker qualification.

The following direct expenditure item includes all expenditures for operating construction machinery used directly in construction work. Expenditures for operating small mechanisms do not come into this item; they are included in overhead expenditures. Expenditures for machinery operation are divided into two basic types, which are the following: single and current expenditures. The characteristic feature of single expenditures is the fact that they do not take place constantly but only at a specific time and do not depend on the length of stay of the machinery at the construction site. These include expenditures for transportation and delivery of construction machinery and maintenance personnel from the rental base to the site, expenditures for assembly, disassembly, refitting and test runs of machinery and, finally, expenditures for equipping and dismantling temporary structures necessary for installation and operation of machinery. Current expenditures are characterized by the fact that they are constantly necessary expenditures and their size changes in dependance on the length of time the machinery is at the construction site. Current expenditures for operating construction machinery are the following: basic wages of workers engaged in operating and maintaining the machinery, cost of electricity, fuel, lubricants and other auxiliary materials, machinery depreciation, expenditures for average and current machinery repair and rental payments for use of machinery which has been rented, together with deductions for maintenance of the machinery rental base. Calculation of expenditures for machinery operation can be made either per time unit (per machinery-shift) or per work unit. In view of the fact that construction machinery at various large construction jobs can work on several units, the question arises of the distribution of expenditures for machinery operation at the individual units. In practice this question is resolved as follows: one-time expenditures are distributed monthly among the various units on the basis of the time in operation by the machinery at the various units. Current expenditures are distributed among the various units proportional to the estimated cost of worked machine-shifts at the individual units. Other dir-

ect expenditures include the services of transportation of the organization and of an outside organization, that is, expenditures for transporting construction materials and equipment from the warehouse to the job (within the working zone), expenditures for removing dirt from the construction site, as well as the cost of steam, water and compressed air consumed in construction work.

The second large group of expenditures for construction is the overhead expenses group. They are comprised of four types of expenditures. Administrative-executive expenditures are connected with administration and technical management. They comprise 35-40% of the total overhead expenses. They consist of the following expenditures: basic and supplementary wages for engineering-technical personnel, office workers and junior service personnel (including deductions for social insurance), expenditures for business trips by administrative-management personnel, expenditures for urban transportation, (including expenditures for the maintenance of automobiles -- depreciation and running repairs), office, telephone and mail-telegraph expenditures, expenditures for maintenance and running repairs on office facilities and equipment, as well as depreciation of basic equipment, bonuses for administrative-management and technical personnel included in the wage fund, and, finally, deductions for maintaining the Central Trust apparatus. In view of the fact that administrative-executive expenditures form a high percentage of the total overhead expenditures, their quota is approved separately, as well as kept separately in the accounts. A large part of these expenditures is comprised of the wages of the administrative-executive personnel. The total wages in this item reach 75-85%. Therefore, a clear-cut determination of the number of administrative-management and technical personnel is of great importance.

The second type of overhead expenditures are expenditures for worker services. These include the following: supplementary wages for production workers, deductions for social insurance, expenditures for labor protection and safety techniques and housing-communal services. The clause "supplementary wages for production workers" includes the following expenditures: paid vacations and compensation for unused vacation time, remuneration for work stoppage due to weather, additional payment to brigadiers for brigade leadership, payment of subsidies for leaving work (discharge, leaving for military service, etc.), remuneration for the time spent fulfilling state obligations, remuneration to workers sent elsewhere for training but appearing on the personnel list of the construction organization, payment for breaks taken by breast-feeding mothers, and pay-

payment for reduced hours by minors. Calculation for paid vacations is made on the basis of the actual average yearly wage and vacation length (on the basis of the collective agreement). The sum of payments for work stoppages due to weather is determined on the basis of factual data on work stoppages and average wages. The sum-total of supplementary payments to brigadiers for brigade leadership is calculated on the basis of current provisions. The brigadier has the right to receive 3% supplementary wages (but no more than 500 rubles per month) if the brigade fulfills its production norm, if the brigade contains no less than 10 persons -- on general construction jobs or no less than 6 persons -- on special jobs and assembly jobs. All other types of payments are determined on the basis of current provisions and on the basis of collective agreements. "Deductions for social insurance " are determined on the basis of present law. The amount of deductions for social insurance is established on a percentage of the total sum of basic and supplementary wages. "Expenditures for labor protection and safety technology" are determined according to established rates for the various departments. The rate for these expenditures is established at 0.3-0.35% of direct expenditures on construction jobs. The basic part of expenditures for labor protection and safety technology is comprised of wages, the percentage of which reaches 50-60. The clause "housing-communal services" includes, in the first place, expenditures connected with covering the difference between expenditures and income of housing-communal economy for serving the needs of construction workers (for example, covering a portion of the rent by the construction organization), in the second place, expenditures for the cultural-daily needs of the workers of construction organizations, a part of which, in accordance with the collective agreement, is covered with expenditures for construction. Determination of the amount of these expenditures is made on the basis of the estimate of expenditures and income of housing-communal economy.

The next type of overhead expenditures are <u>expenditures for work organization and production</u>. This group of expenditures includes expenditures for watchmen, expenditures for the organized recruitment of workers, for the maintenance of production equipment, and tools and other expenditures. "Expenditures for fire brigade, military-type guard and watchmen" consist of expenditures for the maintenance of guard personnel (basic and supplementary wages, deductions for social insurance), expenditures for the maintenance of fire fighting equipment and tools, as well as depreciation and running repairs, wear on temporary structures serving the purpose of guard duties.

Most of this item is comprised of the wages of the guard personnel. The size of this personnel is determined by the higher organization in accordance with the personnel schedule. All expenditures connected with recruitment of workers, conducted both centrally and non-centrally, are included in the item "expenditures for the organized recruitment of workers." These expenditures are the following: payment of one-time allowances to workers, payment of per diems for travel time, payment for worker transport (with their families) to the railroad station, as well as payment for railroad and water transportation, payment for medical examination and expenditures for maintaining the apparatus for the organized recruitment of workers. "Expenditures for maintaining production equipment and tools" consist of the following: expenditures for maintaining small-scale production mechanisms and devices (cost of electricity, depreciation, running repairs, assembly and dismantling, etc.), expenditures for wear on temporary small unnamed structures and contrivances serving the needs of construction, expenditures for wear on production tools and equipment of low value. Low-value, rapid-wearing tools and equipment include those which are not included among basic means of production (value of less than 300 rubles, independent of length of service, or with length of service of less than one year, independent of value). In calculating wear on small, temporary, unnamed structures one proceeds from the length of service, or if the length of service is greater than the period of construction, from the period of construction. The basis for calculating the sum-total of wear is the original cost of these temporary structures, subtracting the cost of reusable materials (after dismantling). The item "other overhead expenditures for work organization and production" includes expenditures for efficiency measures and standardization measures (payment for efficiency measures, payment for work done in rate setting, expenditures incurred in drawing up rate handbooks, etc.), expenditures for testing construction materials, structures and construction elements (expenditures for quality checks, expenditures for maintaining construction laboratories and others, travelling expenses of highly-skilled workers to special jobs), equipment assembly, sanitary-technical structures and others), expenditures for organization of the construction site (temporary roads, construction site clearing, etc.), expenditures connected with handing over the finished units (cleaning up construction trash from the premises, washing floors, doors, etc.).

Finally, the last type of overhead expenditures are

non-production expenditures. These include, in the first place, all fines, penalties, forfeits, paid to transport organizations for stoppage of means of transport in connection with violation of contract, as well as interest paid to the bank for extended loans; in the second place, non-delivery of materials (at the unit warehouses -- above-norm losses), loss and damage to materials during the production process. The sum-total of overhead expenditures comprises a significant proportion of construction cost. Therefore, the government devotes much attention to setting proper rates. Overhead expenditure rates are established and approved by the government. We should note that above-norm overhead expenditures on equipment assembling jobs result in an additional 3% of the basic wages of the workers for paying for auxiliary materials used in assembly. A characteristic of overhead expenditures consists in the fact that most of them are connected with products of all types of jobs and not individual types. Therefore the distribution of overhead expenses can be effected indirectly, conditionally.

The distribution of overhead expenditures among various units is done as follows: those overhead expenses, the rate of which is determined in a percentage of direct expenditures, are distributed among various units proportional to the actual sum of direct expenditures for these units. The overhead expenditures, the rate of which is established in relation to the basic wages of workers, are distributed proportionally to the actual worker wages debited for the various units. Overhead expenditures are distributed also among the various plants and types of jobs. Administrative-executive expenditures of basic production are distributed among construction and assembly jobs proportionate to the basic wages of workers employed at these jobs. The sum-total of these expenditures of non-basic plants is distributed among the various plants proportionate to the basic wages of workers employed in them. Distribution of supplementary wages, the sum-total of deductions for social insurance, housing-communal expenditures, expenditures for labor protection and safety-technology, as well as expenditures for wear and tear on low-value tools and equipment -- among basic and non-basic production -- is done proportionally to the basic wages of the workers. All remaining types of overhead expenditures refer to basic production and are distributed among construction workers proportionate to the basic wages of the workers employed at these jobs.

As can be seen from the above, the grouping of expenditures for production in capital construction has several unique features in comparison with the classification of expenditures for industrial production. In industry, one uses in planning and calculation a grouping of expendi-

tures according to elements, as well as their calculation grouping. Grouping production expenditures according to elements has as its aim a characterization of the proportion of basic factors of production, the percentage of live and transferred labor in creating output. On the basis of this grouping, it is possible to determine the relationship between the expenditures for live and transferred labor, as well as to calculate net production. In accordance with this grouping, expenditures for production are divided among the following elements: raw and basic materials, auxiliary materials, fuel, electricity and steam from other sources, basic and supplementary wages, deductions for social insurance, other cash expenditures, sinking fund deductions. The calculation grouping of expenditures for production (according to expenditure items) is used in order to show how expenditures were made, to what degree the various sectors of production participate in the formation of production cost. With this aim certain types of expenditures are joined into complex items (for example, shop, all-plant expenditures), characteristic for which is the fact that they consist of expenditures for live labor and for transferred labor. In capital construction the basic method of classifying expenditures is their calculation grouping (according to expenditure items). The element grouping of expenditures is used only in rare, individual cases, with the aim of analysis and determination of net production. The calculation grouping of expenditures in capital construction differs considerably from the same grouping in industry. In industry, when a calculation grouping of expenditures is made for production, they are divided into direct and indirect. The indication of direct expenditures is the fact that they are directly connected with individual types of production and therefore can be directly attributed to the cost of individual types of production. Indirect expenditures are characterized by the fact that they are connected with total production, and not individual types, as a result of which they can be distributed among the various types of production only indirectly. On the other hand, expenditures for production in industry are divided into basic and overhead. The characteristic feature of basic expenditures consists in the fact that they are directly connected with the technological process. Overhead expenditures are connected with servicing and directing production. In capital construction the break-down of expenditures into direct and overhead does not correspond to the distribution of expenditures in industry. Direct expenditures for construction include basically those expenditures which are directly connected with the technological process; that is, under the term

direct expenditures we mean those types of expenditures which are determined directly, according to individual types of construction work (in industry -- basic expenditures). Overhead expenditures include basically those expenditures which are connected with the total production (in industry -- indirect expenditures). Therefore, their determination as well as their distribution among individual jobs can take place only indirectly, on a conditional basis (on the basis of direct expenditures or basic wages). A characteristic feature of classifying expenditures in capital construction is the fact that the items include simple (for example, basic wages for workers) and complex (for example, expenditures for machinery operations). These latter consist of simple items (expenditures for machinery operation, for example, consist of wages of workers employed in operating machinery, depreciation in cost of auxiliary materials, electricity, etc. In industry the item "expenditures connected with equipment operations" which form a part of the shop expenditures, do not include wages). Consequently, a determination of the total sum of the various simple expenditures, (for example, a determination of the total wage sum) can be made only with the aid of supplementary calculations. There is also a certain inconsistency in classifying expenditures for capital construction. For example, the group "direct expenditures" includes in the first place, overhead expenditures (for example, deductions for maintaining machinery rental bases) and, in the second place, indirect expenditures (expenditures for assembly and dismantling of machinery, procurement-warehouse expenses, etc.).

The use of complex expenditure items facilitates and simplifies to a considerable measure the calculation of actual expenditures for construction production. For example, calculation of expenditures connected with the operation of construction machinery is easier in a complex form than for individual primary elements, and of course, joining simple expenditures connected with machinery operation into one complex item makes it possible to determine the total cost of job mechanization. In this manner, it also becomes possible to determine the total sum of administration-executive expenditures. The use of complex expenditure items simplifies and facilitates not only calculation of actual expenditures but estimates. For example, individual items of administrative-executive expenditures are interconnected so closely (certain ones proceed from others) that it is expedient to determine them in one estimate in the "administrative-executive expenditure estimate". It is necessary to note certain substantial defects in the manner of classifying and rate-setting of expenditures in

capital construction. As is known, the use of industrial methods in construction is becoming more and more widespread, a high level of mechanization has been achieved, and seasonal construction has been eliminated to a great degree. All of this leads to a situation whereby labor conditions in construction are coming closer and closer to labor conditions in industry. It follows that calculation of cost in capital construction should correspond to modern conditions and should approximate calculation of cost in industry. One of the direct expenditure items is the item "basic worker wages." The major part of the expenditures in this item is comprised of manual labor, since wages of workers engaged on mechanized jobs are included in the item "expenditures for operating construction machinery." However, as a result of the successful fulfillment of tasks in work mechanization, the proportionate weight of manual labor and, together with that, expenditures for manual labor, are decreasing constantly. Therefore, it becomes more and more meaningless to separate these two types of wages. Another important difference between the calculation of expenditures in construction and industry is the following: supplementary wages, deductions for social insurance and paid vacations are direct expenditures by their very nature (in industry they are direct expenditures), while in present calculations of construction expenditures they are included in the overhead expenditures, a fact which cannot be considered correct. It is also incorrect that expenditures also include (overhead expenditures) such expenditures as have no relation to net cost. For example, expenditures connected with covering losses in housing-communal economy. In industry these expenditures are not included in production cost. It is necessary to systematize also the calculation of losses due to faulty production and alteration. The preceding chapter noted that earning rates are also established for correcting faulty production, as well as for the production of other operations and other operations for correcting faulty production are also included in the order (without personal responsibility). All of this follows from the fact that in construction there is no individual calculation item for calculating losses due to waste and spoilage. If jobs are done to correct faulty construction, expenditures for these jobs are included by the sub-contractor in the acceptance document, and with the general contractor they are included without personal responsibility in the various items: materials, wages, etc. It would be more correct to place the sum-total of losses due to faulty production and alterations on a special waste and spoilage account, thanks to which this sum could form a separate

part of overhead expenditures (not only the cost of wasted material which is included in non-production overhead expenditures).

4. Study of Cost Dynamics and Organization of Cost Indices in Capital Construction

Two types of factors influence the level of net cost and production cost in capital construction: production factors, depending completely on the activities of construction organizations (for example, the level of mechanization in industrialization, work organization, materials use, etc.) and planning-design factors dependent on planning work (for example, the choice of rational decisions in planning buildings and other structures, the elimination of excesses in planning, the use of standardized plans, etc.). In accordance with this break-down, two types of net cost level and dynamics indices are differentiated. The net cost (cost) level and index of construction production reflects the influence only of production factors. Such indices, as for example, net cost of square meters of bricklaying, square meters of earth-moving and others reflect the level of expenditures which is the result of commendable operations by the construction organization. These indices can be established independent of the degree of completion of the individual units. The finished production net cost (cost) level and index reflect the influence not only of production, but planning-design factors. These indices reflect the level or dynamics of net cost (cost) of a unit of completed units (for example, square meters of housing, kilometers of railroad track, etc.). They are established on the basis of data on completed units. In view of the fact that construction of individual units possesses a lengthy production cycle, current statistical study of cost in capital construction is made on the basis of expenditures for construction production and not for the finished product.

A characteristic feature of the indices for lowering costs is the fact that they cannot be established in relation to comparative products (as in industry) as a result of the varying nature of the finished unit. In studying net cost (cost) of construction production it is quite important to compare actual figures with estimated and planned figures, since expenditures pertain not only to a definite finished unit, but to a definite volume of work done during the account period. Therefore, it is necessary to check whether actual expenditures do not include expenditures which pertain not to the account period but to other periods (for example, class of materials which have been procurred but

not yet been used), not included in the volume of work completed, work completed in other periods (particularly work on incomplete production.) It is also essential to check whether work has been included in the work volume fulfilled during the account period of the given construction organization, which was done by sub-contract or other special organizations. It is also necessary to show the volume of extra-plan work (and expenditures) and to resolve the question as to whether they are justified or whether they cannot be included in the volume of work completed.

Only after checking actual figures is it possible to compare them with other figures. Actual expenditures for production of construction work can be compared with plan or estimate expenditures of this work -- in such a case the index obtained characterizes plan fulfillment for net cost or cost decrease for construction in comparison with estimate cost in the account period, or with the actual cost of work completed in other periods, when the index characterizes the change in the actual construction cost through a period of time. Study of cost dynamics in capital construction is done on the basis of estimated prices replacing the system of inflexibile prices. If estimated prices do not change during the course of several years they can be used as inflexible prices. The actual construction cost decrease is determined by comparing the actual cost of work completed during the account period with its estimated cost. The formula of this index has the following form

$$I = \frac{\sum q_1 C_1}{\sum q_1 C_x}$$

Where: q_1 -- volume of work fulfilled during the account period (in natural indices),
C_x -- Estimated price per work unit,
C_1^x -- Actual cost per work unit completed.

The numerator of the ratio ($\sum q_1 C_1$) stands for the actual cost of completed work and the denominator ($\sum q_1 C_x$) the estimated cost of this work. This formula can be used also to calculate the index of plan fulfillment for construction cost decrease. In this case the actual cost of work completed during the account period is compared with planned cost, that is, the index formula is expressed in the following form:

$$I = \frac{\sum q_1 C_1}{\sum q_1 C_{pl}}$$

Where: $\Sigma q_1 C_{pl}$ -- the planned cost of completed work

Let us assume that the figures in the table below refer to one construction organization and represent the estimated and actual cost of work completed, while estimated prices do not change from one year to another.

Years	Actual Cost of Completed Work (In 1000 rubles)	Estimated Work Cost (In 1000 rubles)	Index in Percent
1955	1278	1200	106.5
1956	1719	1800	95.5

The actual cost of completed work in 1955 exceeded its estimated cost by 6.5%, and in 1956 it was 4.5% lower than the estimated cost. On the basis of these figures it is also possible to calculate the index characterizing the actual construction cost of the construction organization. The actual cost index, calculated on a basis of estimated cost, is obtained in our example by dividing the proper indices; that is, it comprises 89.67% $(\frac{95.5}{106.5} \times 100)$. The actual construction cost level in 1956 is 10.33% lower than in 1955. The actual cost index formula will be the following:

$$I = \frac{\Sigma q_1 C_1}{\Sigma q_1 C_x} : \frac{\Sigma q_o C_o}{\Sigma q_o C_x};$$ the denominator of this index $(\frac{\Sigma q_o C_o}{\Sigma q_o C_x})$ is the construction cost actual decrease index against the estimate in the basic period. The correctness of this index can be proved as follows. The estimated job cost in 1956 is 1.5 times greater than in 1955 $(\frac{1800}{1200})$. If we assume that the volume of work fulfilled in 1956 is evaluated according to actual 1955 prices, the actual cost of this work, done in 1956, would be 1,917,000 rubles (1273 x 1.5). However, the actual cost of work fulfilled in 1956 is only 1,719,000 rubles. The actual construction cost index in 1956, is, in comparison with 1955, 89.67% $(\frac{1719}{1917} \times 100)$.

It follows that, not knowing absolute figures on actual and estimated fulfilled work cost but knowing only the indices which characterize actual decrease in cost in comparison with the estimated cost for several years, it is possible to calculate the actual construction cost index in each period and for any basis. The same method can be

used to determine individual indices (sub-indices) which characterize actual cost dynamics of individual cost items and, on this basis, to determine the general actual cost index (see Table on this page). On the basis of splitting up costs according to constituent elements (according to expenditure items), it is possible to establish indices which characterize the change in actual cost of each individual item and, along with this, it is possible to analyze the individual items and establish the influence of each of them to the total cost dynamics. With the aid of sub-indices it is possible also to determine the general index, using as percentages the percentage of the individual item and the total cost of work fulfilled (according to estimate) in the basic period.

Expenditure Items	Average Completed Work Cost		Actual Work Cost		Relation of Actual Cost to Estimated		Actual Cost Index In Percentage
	1955	1956	1955	1956	1955	1956	
	In 1,000 rubles				In %		
Materials	540	810	570	794	105.5	98.0	92.89
Basic Wages	240	360	261	340	108.7	94.4	86.84
Operational Expenses for machinery	120	180	120	170	100.0	94.4	94.40
Other direct expenditures	120	180	128	165	106.6	91.8	86.10
Overhead expenditures	180	270	199	250	110.5	92.6	83.80
Total	1200	1800	1278	1719	106.5	95.5	89.67

This method can also be used to obtain the average actual cost index which can be expressed in the following formula:

$$I = \frac{\sum \left(\frac{q_1 C_1}{q_1 C_x} : \frac{q_o C_o}{q_o C_x}\right) q_o C_x}{\sum q_o C_x}$$

Where $q_o C_x$ -- estimated cost of individual items in the basic period. We shall demonstrate the calculation of this index with the following example: Under the conditions of our example

this index would be equal to the following:

$$\frac{0.929 \times 540 + 0.868 \times 240 + 0.944 \times 120 + 0.861 \times 120 + 0.838 \times 180}{1200} = 89.67\%$$

that is, the same index which will be obtained by the aggregate formula index. The correspondence between these two forms of actual cost index is also evident due to the fact that after the transformation of the average equational formula index we obtain its aggregate formula. Until the present, we have dealt with construction cost indices which are determined on the basis of estimated cost. However, a change in the level of construction cost can be calculated also on the basis of actual data of various periods. In such a case sub-indices are used which determine change in actual expenditures in the most important construction cost items. The sub-index which characterizes the change in material expenditures, is calculated according to the following formula:

$$I_c = \frac{\sum q_1 m_1 P_1}{\sum q_1 m_o P_o},$$

Where: q_1 -- quantity of units of construction elements and types of work done during the account period,

m_o and m_1 -- individual expenditures of individual types of materials per unit of construction elements and types of work during the basic and account periods,

P_o and P_1 -- average actual cost per unit of materials expended in the basic and account periods.

If, for example, we assume that the actual cost of materials expended for a specific volume of work is 5,360,000 rubles in 1955, and the actual cost of materials expended for the same volume of work in 1954 was 5,420,000 rubles, the sub-index of material expenditure change is 98.89% $(\frac{5360}{5420} \times 100)$.

In determining the sub-index characterizing the change in expenditures for wages, one proceeds from the premise that a change in average wages depends primarily on changes in labor producitivity and job structure (percentage weight of various professions). The influence of this latter factor on average wage dynamics -- on a large scale -- is insignificant, and therefore it does not have great significance in determining the growth of average

wages. However, in various construction organizations, a change in job structure can influence the average wage dynamics index. Therefore, in such cases one proceeds from the inflexible structure of the wage fund (of the account period). An increase in labor productivity is a factor which lowers the cost of construction and therefore, in determining the sub-index which characterizes change and wage expenditures, it is necessary to make a correction for this factor. A formula of this sub-index can be expressed in the following form:

$$I_c = \frac{f_1}{f_o} : \frac{q_1}{q_o}$$

Where f_o and f_1 -- average worker wages in the basic and account periods,

q_o - q_1 -- average wages per worker in the corresponding period.

Assume that the average monthly worker wage will be 980 rubles in 1955 and 950 in 1954. The increase in average wages amounts to an overall 103.1%. Let us assume further that in 1955 labor productivity per worker was 5.4% higher than in 1954. It follows that the wage expenditure sub-index will be 97.81% $\left(\frac{1.031}{1.054} \times 100\right)$. Finally, the sub-index characterizing change in overhead expenditure level is calculated by dividing the actual level of overhead expenditures during the account period by the corrected level of the basic period. The formula for this sub-index is the following:

$$I_c = \frac{H_1 \cdot 100}{P_1 \quad \%H_o},$$

Where H_1 -- actual level of overhead expenditures during the account period,

P_1 -- sum of actual direct expenditures during the account period,

$\%H_o$ -- actual rate of overhead expenditures during the basic period (that is -- the relation of the sum-total of overhead expenditures to direct expenditures).

Let us take the following example: Let us assume that the actual cost of work carried out in 1956 is 9,310,000 rubles, including the sum-total of direct expenditures -- 7,660,000

rubles, and the sum-total of overhead expenditures -- 1,650,000 rubles. The relationship of overhead expenditures to direct in 1955 is 22.16% (actual). The overhead expenditure sub-index in this case is equal to the following:

$$\frac{1650 \times 100}{7660 \times 0.2226} = 97.2\%$$

The general index, expressing change in actual cost of completed work is obtained by an equation with the individual sub-indices, while the percentages are the actual cost of the individual items in the account period, or their percentage rate in the total actual cost of work carried out during the account period. This formula can be presented as follows:

$$I = \frac{\Sigma(I_c \; q_1 C_1)}{\Sigma q_1 C_1} \quad \Sigma\left(I_c \; \frac{q_1 C_1}{\Sigma q_1 C_1}\right)$$

The following designations are used in these formulas:

I_c -- sub-indices of material expenditures, wages, overhead expenditures,

$q_1 C_1$ -- actual cost of individual expenditure items in the account period,

$\frac{q_1 C_1}{\Sigma q_1 C_1}$ -- proportionate weight of the actual cost of the individual expenditures items in the account period.

In the example examined by us the completed work actual cost index (general) will be calculated in the following manner:

Expenditure Items	Actual Cost of Completed Work in 1955, in 1,000 rubles	Sub-Index in Percent	Product of the Sub-Index Times the Actual Work Cost During the Account Period
Material	5360	98.89	530,050
Wages	2300	97.81	224,963
Overhead expenditures	1650	97.20	160,380
Total	9310	-	915,393

The general completed work actual cost index is 98.3% $(\frac{915,393}{9310})$.

It is necessary to keep in mind that a study of the actual cost of construction by comparison of the actual cost level of several periods is done on the basis of the inflexible composition of actual expenditure items (of the

account period). However, within one construction organization the expenditure structure can fluctuate sharply depending on changes in work structure. A change in work composition is insignificant, even unnoticeable, only on a large scale. Therefore, organization of actual construction cost indices on the basis of comparing the actual cost level of several periods is possible only in a case whereby the figures pertain to a sufficiently large number of construction organizations, that is, only within the limits of individual ministries, economic rayons or capital construction as a whole. Another type of index characterizing change in construction cost is the finished construction product cost index. It characterizes a relative change in the cost of completed construction units. The formula for this index can be expressed in the following manner:

$$I_1 = \frac{\sum P_1 C_1}{\sum P_1 C_o}$$

Where P_1 -- number of units of measurement of finished construction units in the account period (sq.m of housing, km of railroad bed, sq m of production space, etc.).

C_o and C_1 -- cost per unit of completed units in the basic and account periods.

The basic feature of this index is the fact that it reflects the influence both of production and planning-design factors. The finished product cost index is determined not on a basis of comparing actual cost with estimated cost, but on a basis of comparing actual cost of completed units in differing periods. The size of this index depends on the development of the plan itself as well as on production factors. The finished product cost index for construction characterizes relative change in the cost of completed units put into operation during the account period, although their construction was not necessarily completed during the account period. In the majority of cases the time of construction and time of beginning operations for the various units do not coincide. Therefore, this index characterizes partially the results achieved in previous periods. The account period and the period for erecting buildings and other structures in this case merge. The difference between these two periods becomes greater as the production cycle for construction becomes longer and the account period is smaller. The finished product cost index for construction is calculated primarily for various types of construction (housing, cultural-welfare, industrial and other construction). The expediency of calculating an index according to types of construc-

tion is conditioned by the fact that the action of planning-design factors as well as the degree of planning development differ for various types of construction. Together with this, the finished product cost index is also used for all types of construction products, with the aim of obtaining a general index. Finally, this index can be used to compare finished product cost, produced by various forms of construction (large block, brick, large panel construction). In this case the basis of the index formula will be, instead of a quantity of measurement units (ΣP_1), the measurement unit itself (for example, 1 sq m of housing) or a quantity of finished unit measurement units, for units erected according to a more improved form of construction. This latter method can also be used to obtain the amount of savings achieved as a result of the application of perfected, industrial forms of construction, by subtracting from the amount of the denominator the amount of the numerator ($\Sigma P_1 C_0 - \Sigma P_1 C_1$).

We shall demonstrate methods of applying the finished product cost index for construction with the following example from the field of housing construction.

Forms of Construction	1955		1956	
	Total Cost of operating units in million rubles	Total Area of operating units in 1000 sq m	Total Cost of operating units in million rubles	Total Area of Operating units in 1000 sq m
Brick Construction	26,000	20,000	25,200	21,000
Large Panel Construction	4,200	4,000	5,200	5,200
Total	30,200	24,000	30,400	26,200

The finished product cost index for housing construction as a whole is 92.2% ($\frac{30400}{26200 \times \frac{30200}{24000}}$), that is, actual expenditures per sq m of housing of buildings going into use in 1956 decreased 7.8% in comparison with 1955. This index reflects on the one hand the influence of cost decrease per sq m of housing for each type of construction. Cost decrease for each sq m of housing for finished buildings put into use in 1956, with brick construction, is 7.7% in comparison with

1955 $\left(100 - \frac{25200}{21000 \times \frac{26000}{20000}} \times 100\right)$, and with large panel construction -- 4.8% $\left(100 - \frac{5200}{5200 \times \frac{4200}{4000}} \times 100\right)$. On the other hand, the general index also reflects the influence of increase in proportionate weight of large-panel construction in total construction volume. Large-panel construction is more economical than brick construction. The cost per sq m of buildings put into use with large-panel construction in 1955 is 19.3% lower than for brick construction. $\left(100 - \frac{4200}{4000} : \frac{26000}{20000}\right)$, and in 1956 -- 16.7% $\left(100 - \frac{5200}{5200} : \frac{25200}{21000}\right)$. The savings on each sq m of housing was 250 rubles in 1955 $\left(\frac{26,000,000}{20,000} - \frac{4,200,000}{4,000}\right)$, and in 1956 -- 200 rubles $\left(\frac{25,200,000}{21,000} - \frac{5,200,000}{5,200}\right)$. The savings obtained in large-panel construction, 1 billion rubles in 1955 (250 X 4,000,000), and in 1956 -- 1 billion 40 million rubles (200 X 5,200,000); or with the use of the index formula, the sum-total of savings in 1955 is $\left(4000 \times \frac{26,000}{20,000}\right) - 4200 = 1$ billion rubles, and in 1956 $\left(5200 \times \frac{25,200}{21,000}\right)$ 5200 = 1 billion 40 million rubles. In spite of the defect which was shown above, this index plays an important part in checking completed unit cost and discovering possibilities for further decreases, demonstrating the results of the application of progressive forms of construction. Therefore, it should be broadly used as one of the basic construction cost dynamics indices.

5. Capital Construction Cost Analysis and Ascertaining Reserves for Decreasing It

The basic tasks in analyzing data on construction cost are the following: Control over plan fulfillment for construction cost decrease, determination of size and reasons for deviation of actual expenditures from estimated and plan cost of work completed, ascertainment of reserves and potential for eliminating losses, working out measures for mobilizing inner resources for further construction cost decrease. Deviation of actual expenditures from estimated cost of completed work can only be a result of the influence of production factors. Indices on decrease of construction cost do not reflect the defect of planning-design factors. In analytical work, based on a running calculation of production expenditures, we are limited only to an analysis

of the economic activities of construction organizations, an analysis of those factors which depend completely on construction organizations. Analytical tasks can be carried out only by a detailed analysis of individual expenditure items, since only in such a case is it possible to establish the concrete reasons for deviation of actual expenditures from estimated and planned cost of completed work and to carry out measures essential for further work improvement.

Material expenditures comprise an average of 60% of completed work costs. Their proportionate weight depends primarily on the type of work. For example, the proportionate weight of material expenditures for earth-moving is approximately 10 to 14%, on equipment assembly -- 20 to 24%, on reinforced concrete jobs -- 70 to 75%. The proportionate weight of material expenditures in construction cost increases from year to year, a fact which is an expression of the increase in the general productivity and technological progress. For example, in 1945 the proportionate weight of material expenditures on construction jobs in actual cost was 52.2% and in 1952 -- 58.3%. As a result of a large proportinate weight of material expenditures, it is necessary to go into detail on ways of economizing on these expenditures. An important source of lowering material expenditure cost is decrease of wholesale prices for material and transport rates. Since 1950, three price and transport rate changes have been made. Present prices for materials are approximately 22% lower than prices established on 1 July 1950. This made it possible to decrease construction costs approximately 12 to 13%. However, decrease in construction cost due to decrease in wholesale prices for construction material does not characterize the results of the efforts of individual construction organizations to effect savings. Therefore, in accounts savings achieved due to decreases in wholesale prices are singled out of the total sum savings due to construction cost decrease. Material expenditure cost also depends on the operations of subsidiary and auxiliary construction organization plants. Production cost of subsidiary and auxiliary plants which are on independent accounting systems is determined according to established state prices. Therefore, the construction material net cost level for materials produced in these plants is not reflected in construction costs. However, those subsidiary and auxiliary plants which are within the same accounting system of the construction organizations produce at actual net cost. All expenditures for production in these plants are run through the books of the construction organization. Profit or loss in subsidiary or auxiliary plants which do not have their own

accounting balance is reflected directly in the cost of construction materials and, consequently, in the cost of construction. At present there are many small, uneconomical plants for the production of construction materials and elements for construction jobs. Many of them operate not only inefficiently, but produce low-quality products. Therefore, shut-down of these small-scale plants and formation in their place of large industrial enterprises for producing construction materials and elements would make it possible to lower cost of materials and at the same time lower construction cost. A considerable savings in material expenditures can be achieved also by decreasing transport expenditures, comprising 18 to 20% of the cost of materials. A most important means for decreasing transport expenditures are the following: Use of local resources, curtailment of long-distance material transport and use of inexpensive means of transport. As has been indicated, estimated rates are average rates. The cost of freight turn-over is established, for example, on the basis of a definite means of transport and average transport distance. Paying attention to all possible ways of decreasing these average figures, it is possible to decrease transport expenditures to a significant degree. Expenditure decrease is particularly important for materials which are priced f.o.b. plant, that is, the transport costs of which (to the warehouse) are a matter for the construction organization. We shall demonstrate calculation of savings on decreasing distance transport in the following example:

Type of Materials	UNIT of Measure	Quantity of Material	Distance in km		Freight Turnover Vol. In T/KM		Estimated Transport Cost per T/KM in rubles
			Estimated Ave.	Actual	Estimated Ave.	Actual	
Brick	1000	650x	7	6	6300	5400	1.2
Cement	T.	60	8	8	480	480	1.7
Sand	T.	140	15	11	2100	1540	1.6
Quarry stone	T.	80	21	16	1680	1280	2.3
Total					10560	8700	

X -- 650,000 bricks = 900 tons.

The cost of total freight turn-over in our example

is equal to the following: According to estimates -- 15,500 rubles (6300 X 1.2 + 480 X 1.7 + 2100 X 1.6 +1680 X 2.3), actually -- 12704 rubles (5400 X 1.2 + 480 X 1.7 + 1540 X 1.6 + 1280 X 2.3). As a result of cutting down distance transfer (as a result of changes in procurement areas stipulated in the estimate) savings were obtained of 2,796 rubles in comparison with the estimate (15,500 - 12,704). The same method can be used to calculate the savings obtained as a result of changing the method of transporting materials as provided in the estimate. Considerable savings can be achieved with a more efficient use of materials. One of the reasons for material spoilage is inefficient delivery to the job, particularly brick delivery by dumping, where losses amount to 5 to 6%. For example, with container brick delivery, these losses could be eliminated almost completely. Even more effective is the so-called packet delivery of wall material (on pallets). It lowers total delivery cost by more than 10% in comparison with container delivery (the cost of a pallet is 8 times less than a container). Large reserves are also to be found in the field of organizing warehousing and storage of materials and, primarily, open storage materials,(for example, sand), since the expenditure rate of these materials is often violated as a result of incorrect organization of delivery and storage. An important factor in lowering expenditures for storage of materials is decrease in construction time, for these expenditures change in proportion to the length of construction time. Procurement-warehouse expenditures are a constituent element of the price of materials. Maximum amount is established by rates on a percentage of cost of materials. The estimated rate of procurement-warehouse expenditures is 1.94% of the cost of construction and sanitary-technical materials, 1.25% of the cost of equipment and 0.8% of the cost of metal structures. Within the limits of these rates considerable expenditure decreases can be achieved due to elimination of excess links in the apparatus and efficient operation of these organizations. It is essential to exercise control over the expenditure of materials in production. Decreasing normative losses established in the estimate is a source of savings on material expenditures. We shall demonstrate the calculation of savings with the following example:

Type of Materials	Unit of Measure	Estimated Price/Unit in Rubles	Necessary Quantity for work volume according to the standard
Brick	1000	1650	900
Tile		3.2	6460

Type of Materials	Losses in Production				Savings (-) Over-expenditure (+)
	In %		In Natural Units		
	Estimate	Actual	Estimate	Actual	in rubles
Brick	1.4	0.6	12.6	5.4	-11880
Tile	4.5	2.0	290	129	-515
					-12395

The cost of materials (12,395 rubles) obtained due to lowering loss rates (12.6 - 5.4) x 1650 + (290-129) X 3.2) will also be the total savings. On the basis of the savings obtained for individual types of materials and the total estimated cost of all materials, it is possible to calculate the relative savings level. In our example, the relative savings level is 0.8%.

$$\left(\frac{12395 \times 100}{1650 \times 900 + 3.2 \times 6460}\right)$$

Finally, it is necessary to determine also the influence of decreases in material expenditures on decrease on total completed work cost, proceeding from the proportionate rate of materials expenditures in estimated cost. If the proportionate weight of materials expenditures in total estimated costs for work is 62%, and decrease in materials expenditures against the estimate is 2.1%, the decrease in estimated cost due to decrease in material expenditures would be 1.3% $\left(\frac{2.1 \times 62}{100}\right)$.

Large reserves for decreasing construction costs are to be found in the wage fund expenditure. An analysis of the use of wage funds should be made always in connection with work volume fulfillment plan indices. The plan (or estimate) wage fund is recalculated for actual work volume. The difference between this sum and the sum of actual expenditures for wages expresses the savings achieved against the plan or estimate. In analyzing this it is essential to take into consideration that wages are included in all expenditure items and the item (basic wages for workers at basic production) contains only a portion of the total

wage fund. Therefore, in order to analyze the entire wage fund it is necessary to carry out supplementary calculations or in each single item, it is necessary to handle wages also. A basic factor in lowering the percentage of wages in construction cost and an important means for savings in this is increase in labor productivity. Increase in labor productivity brings a relative decrease in number of workers as a result of which savings in wages are achieved. One must keep in mind that the rate of labor productivity increase should outstrip average wage growth rates. An important factor in labor productivity increase in capital construction are mechanization and industrialization. An increase in the level of work mechanization means a decrease in labor consumption and a decrease in labor expenditure. An increase in the level of mechanization creates wage savings independent of the growth in average wages. Let us take as an example the figures in the following table, showing the results of mechanization on concrete jobs:

	Volume of Work Completed Including			
	Total	Manual	Mechanized	Mechanization Level in %
Estimate	365	85	280	76.7
Actual	390	81.1	308.9	79.2

	Price Unit on Wages (in rubles)		Wage Fund		
	Manual	Mechanized		Including	
	Per 1000 cu m of concrete		Total	Manual	Mechanized
Estimate	1050	510	232050	89250	142800
Actual	-	-	242694	85155	157539

As the table shows, the volume of work actually carried out is considerably greater than the estimated volume (by 6.85%). Therefore, the wage fund should be corrected to the actual work volume. The corrected wage fund is 247,940 rubles (232050 x 1,0685). It follows that the absolute sum of wage savings, assuming plan fulfillment was obtained as a result of increased mechanization level, is 5,246 rubles (247940-242694)., Naturally increase in mechanization level brings not only wage savings but an increase in such expenditures as are connected with machinery operations. However, the difference between productivity of manual and mechanized labor is so great that

in spite of the increase in these expenditures, wage savings will always be higher than machinery operation expenditures, especially when mechanization level increase is a result of an improvement in machinery use, since in such a case expenditures connected with machinery operation decrease per unit of product or work. An important means for decreasing labor expenditures, and this includes the actual wage fund, is the use of industrial methods in construction. The use of prefabricated parts, elements and structures at the construction job decreases labor expenditures, decreases the need for personnel. For example, a decrease in labor power requirements as a result of the use of prefabricated parts comprises 70% in using concrete and reinforced concrete slabs, and approximately 50% in using tiles, etc. Decrease in labor expenditures is also the result of labor productivity increase. For example, two bricklayers lay a brick wall in one shift with a volume of 3 to 4 cu m, while two assemblers in the same time can assemble a wall of large blocks which is 6 to 7 times larger (20-25 cu m.). The savings achieved as a result of increasing the proportionate weight of prefabricated and assembled elements and structures against the plan or estimate, as well as against the basic period, are calculated analogous to the above methods. The cost of finished units depends to a great extent also on the duration of construction. It is well known that a cut in the construction time of apartment houses and cultural-communal buildings by one month lowers cost by 1.3%. The greater part of this economy is savings in labor expenditure. It is comprised not only of basic wage savings but in overhead expenditure savings, among which a large proportionate weight is taken up by wages. The influence of labor productivity increase on decrease in proportionate weight of wages in the cost of construction is calculated as follows. Let us assume that during the account period labor productivity for workers increased 12% while average wages increased 4%. Wages of workers engaged in basic production decreased by 7.32%. ($100 - \frac{104}{112} \times 100$). If the proportionate weight of wages in the total estimated job cost is 22%, the portion of wages in the total estimated job cost is lowered 1.61% ($\frac{22 \times 7.32}{100}$) that is, the actual proportionate weight of wages will be 20.39% (22-1.61). One of the basic reasons for wage fund over-expenditure is non-fulfillment of mechanization and industrialization plan, since jobs done manually are considerably more expensive than mechanized jobs. Non-fulfillment of tasks on incorporating industrial meth-

ods also increases job labor consumption against the estimate or plan and therefore leads to an increase in wage expenditures. The other defects causing wage fund over-expenditure are in rate setting. Here one should first note incorrect application of the piece rate and progressive-piece rate remuneration system. In individual cases the piece rate system is used on jobs which should not be subject to rate setting, but are paid according to an hourly wage rate. With the progressive-piece rate labor remuneration system wages increase more rapidly than labor productivity, a fact which can only lead to wage fund over-expenditure, if in other areas (in other items) there are no savings due to the increase of labor productivity. It is necessary to check the correctness of the application of rates and prices and to establish whether they correspond to the rates and prices established in the estimate or plan. With a wage fund over-e penditure it is necessary to ascertain the correctness of the orders: were prices increased, are there additions or incomplete work volume, does the order include work for correcting spoilage and alteration. We shall give the following example in order to demonstrate the methods of ascertaining violations of rates and prices.

	Volume of Completed Work in Rubles	Number of Worked-Man Days	Wage Fund in 1000 rubles	Average Daily production in rubles	Average daily wages in rubles
According to Plan	6000	4800	144	1250	30
Actual	5106	4910	162	1010	33

The work volume task was fulfilled by only 85.1% ($\frac{5106}{6000}$ X 100). Therefore, the wage fund calculated to the job volume fulfillment is 122,540 rubles (144 X 0.851). The absolute wage fund over-expenditure, not taking into consideration work volume plan fulfillment, is 18,000 rubles (162 - 144), and with regard for plan fulfillment in job volume, 39,460 rubles (162-122.54). The total wage fund over-expenditure (39,460 rubles) contains an overexpenditure due to violation of work prices in a sum of 14,700 rubles (162,000 - 4910 X 30). The remaining portion of the overexpenditure is connected with non-fulfillment of production norm (39.46-14.7 = 24,760 rubles). An analysis of expenditures for machinery operations should bee made on

the one hand for the most important expenditure elements (wages, auxiliary materials, etc.), and on the other hand together with construction machinery use indices. Expenditures for machinery operations comprise only an insignificant part of the cost of construction, about 5 to 6%. Their proportionate weight, however, is increasing constantly. For example, the proportionate weight of expenditures for machinery operation in actual cost of construction work completed was 2% in 1945, and 5% in 1955. This is connected with an increase in the level of job mechanization. In connection with an increase in the level of mechanization as well as improvements in machinery use, the portion of the first part of expenditures on operations -- current expenditures -- is increasing and the other portion -- single expenditures -- should decrease. If the level of mechanization increased to a greater degree in comparison with the estimate(or plan) level or level of the preceding period running expenditures can increase significantly in their absolute amount; even one-time expenditures can exceed their foreseen level or the level of the preceding period if the increase in mechanization level is connected not with an improvement in machinery use but with the receipt of new machinery. However, increase in expenditures for machinery operation does not cause an increase in construction costs, because in other items, (particularly in labor expenditures) savings are achieved which exceed this overexpenditure. Important means of lowering machinery use expenditures are the following: improvement of machinery use, curtailment of length of use of machinery at the construction job and decrease in machine-shift cost due to decrease in energy expenditure rates and auxiliary materials. In analytical work one uses a distribution of expenditures for machinery operation not only for one-time and running expenditures but for conditional-constant and alternating expenditures. Conditional-constant are those expenditures which are essential for maintaining machinery under any conditions; expenditures also are made both during machinery operation and during non-use. These include the following: expenditures for delivery of machinery to the job, expenditures for assembly, dismantling, and rearrangement, expenditures for average and current repairs, expenditures for equipment for machinery, cost of lubricants and other auxiliary materials, machine depreciation and expenditures for the maintenance of machinery rental bases. Alternating expenditures include those connected only with machine operations, that is, those which take place only during operations. These are expenditures for the maintenance of service personnel, expenditures for electricity, fuel,

This subdivision of expenditures for machinery operation is important in order to see that a considerable sum of expenditures is independent of machinery use. Conditional-constant expenditures make up about 70% of the total sum of expenditures for machinery operation. In addition, this expenditure subdivision is essential for determining the sum-total of losses due to machinery non-use, for conditional-constant expenditures are made other than machinery use time, during stoppage, while alternating expenditures arise only during machine operations. For example, if the cost of a machine-shift for a single-bucket excavator with a 1/2 cu m capacity bucket is determined in the estimate at 180 rubles, 71% of which are conditional-constant expenditures, that is 128 rubles, each hour of stoppage represents a sum of 15 rubles expended (128:8). Let us assume that there are 148 hours of stoppages for excavators of this type during the account period. Consequently, the sum-total of losses due to non-use of single-bucket excavators is 2368 rubles (148 X 16), since the sum-total of losses due to machinery stoppage is determined by multiplying the number of hours of stoppage by the sum-total of conditional-constant expenditures per machine-hour, and the number of hours of stoppage includes those hours during which the machinery was not in operation due to lack of work. Divergence of actual expenditures for machinery operations from the estimate or planned expenditures takes place in cases whereby established rates of electricity and fuel expenditures are not fulfilled. The amount and cost of these types of energy as well as auxiliary materials are established according to single values per one machine-shift. For example, for a bulldozer with tractor the diesel fuel expenditure norm per one machine-shift has been established at 59 kilograms.

The sum-total of savings or over-expenditure of separate types of energy or auxiliary materials is obtained by subtracting from the cost of actually expended auxiliary materials and energy cost determined on the basis of actually worked machine-shifts and estimate unit value per one machine-shift. A lengthening of construction time as well as delay of machinery on the job longer than the construction time leads to over-expenditure in this item, as well as to an increase in construction cost. In the first case, supplementary expenditures arise as conditional-constant as well as alternating, and in the second case -- only conditional-constant expenditures. The size of these expenditures is considerable. It is sufficient to mention only that the cost of maintaining one tower crane at construction jobs in Moscow costs about 55 to 60,000 rubles a month, independent of the volume of work completed. There-

fore, a shortening of the period of time machinery is at the construction job as well as introduction of two-shift machinery operation are an important reserve for decreasing costs of machinery operations, and, consequently, decrease in construction costs. It is possible to obtain the total savings from increased mechanization level if the sum-total of expenditures for mechanization is subtracted from the sum-total of wage savings achieved as a result of the increased mechanization level. Let us take the following example: in the second quarter of 1956 single-bucket excavators fulfilled 2800 cu m more earth-moving than was provided in the estimate. In order to carry out this volume of work it was necessary to expend 800 man-days (with a 3.5 cu m production norm per shift) of manual labor. Production cost on this job was 25,600 rubles (with a daily average wage of 32 rubles). Excavators carried out this work in the course of twelve machine-shifts, and the completed work cost 14,520 rubles (with an estimated machine-shift cost of 1,210 rubles). This means that as a result of the fact that the mechanization level of earth moving was increased against the estimate, savings were obtained in the sum of 11,080 rubles (25,600-14,520). Overhead expenditures, comprising about 15-17% of all construction work expenditures, are that portion which receives to a considerable degree increase in construction cost. In analyzing overhead construction expenditures it is necessary to keep in mind that a portion of them depends directly on the various items of direct expenditures, for example, savings or over-expenditure of supplementary wages and deductions for social insurance, depend basically on savings or over-expenditure on basic wages. Therefore, an analysis of these expenditures must be made always in close connection with expenditures for basic wages. The same method can be used to establish the relationship between other overhead expenditure items and individual factors upon which they depend. For example, expenditures for labor protection and safety technology depend on the number of workers, expenditures for worker delivery, per diems, etc., also, the volume of completed construction work determines basically the expenditures for guards and fire brigades, wear and tear on low-value tools and equipment, expenditures connected with turning over completed units, etc. A determination of the dependance of individual overhead expenditure items on individual factors is quite significant in studying the reasons for divergences of actual overhead expenditures from their normative level, as well as in determining savings and over-expenditure in the various items. In determining the reasons for fluctuation of the actual sum of overhead expenditures from their normative sum, it is nec-

essary to consider also a change in work structure. It is particularly important to uncover the influence of construction material price decrease, energy price decrease, etc., on change in the proportionate weight of overhead expenditures, since overhead expenditure norms on basic jobs (construction, assembly of metal structures, etc.) are established in relationship to direct expenditures, and price decrease for materials means a decrease in direct expenditures. In order to become convinced of this, let us examine the following example, which includes data for the fourth quarter of 1956 (see table below). As a result of price decrease for construction material, as well as rates for energy (from 1950 to 1955) the cost of completed work was decreased 11.5%, including direct expenditures -- 13.45% ($100-\frac{72.7}{84.0} \times 100$) and overhead expenditures -- 1.25% ($100-\frac{15.8}{16.0} \times 100$). As a result of this change in the structure of job cost the proportionate weight of overhead expenditures increased not only in the total job cost -- from 16 to 17.9% but also in relation to direct expenditures, from which their rate is calculated -- from 19.05% ($\frac{16}{84} 100$) to 21.8% ($\frac{17.9}{82.1} 100$).

	Average Work Cost in Prices for 1950 (in percentage to total)	Price decrease for materials & energy from 1950 to 1955 (in %)	Estimated Work Cost in Prices for 1 July 1955	
			In % to estimated cost in prices of 1 July 1950	In % to total estimated cost in prices of 1 July 1955
Material	63.5	10.7	52.8	59.7
Basic Wages	14.0	-	14.0	15.8
Expenditures for machinery operation	5.0	0.6	4.4	4.9
Other direct expenditures	1.5	-	1.5	1.7
Total direct expenditures	84.0	11.3	72.7	82.1
Overhead expenditures	16.0	0.2	15.8	17.9
Total	100.0	11.5	88.5	100.0

Basic means of lowering overhead expenditures are an increase in labor productivity, shortening of construction time and stringent economy. Approximately one-half of overhead expenditures changes proportionately to a change in the number of workers and wage fund. It follows that an increase in labor productivity which makes it possible to decrease the number of workers and thus decrease the wage fund saves on other expenditures connected with the number of workers and wages (supplementary wages, deductions for social insurance, expenditures for housing-communal services for workers, expenditures for labor protection and safety technology, etc.). Therefore, it is essential to determine those items of overhead expenditures which basically depend on the number of workers and the total wages. An example of this type of analysis is given above. A considerable percentage of overhead expenditures (about 50%) depends directly on the length of construction time (administrative-executive expenditures, expenditures for watchmen and fire brigade, expenditures for housing-communal services for workers, wear and tear on temporary buildings and structures, etc.). A decrease in construction time causes a decrease of these so-called "non-proportional expenditures." If overhead expenditures comprise 16% of job cost, each percent of decrease of construction time makes it possible to lower cost at the expense of a decrease in non-proportional expenditures approximately by 0.07-0.08%. Significant in the matter of lowering overhead expenditures is strict economy -- a careful relationship to tools, equipment, efficient use of temporary buildings and other structures, lowering fines, penalties and forfeits, as well as observance of personnel discipline. A selected check of 173 construction organizations in 1954 demonstrated for example, that there were over 2000 superfluous administrative-executive workers and 2,350 persons who were carrying out the functions of administrative-management personnel but placed in worker categories. The maintenance of excess administrative-executive personnel inevitably causes an overexpenditure in wage fund, in increase in overhead expenditures and an increase in construction costs. Therefore, it is essential to keep strict watch over the observance of discipline and ascertain the correctness of the use of personnel schedules. The influence of overhead expenditure decrease on total construction cost decrease is calculated on the basis of the proportionate weight of overhead expenditures and the sub-index of the change in their amount against the normative amount. If the proportionate weight of overhead expenditures is 15.56% of the cost of completed work, and the estimate provides a proportionate weight in the total estimate cost of 16.2%,

the decrease in overhead expenditures is 3.98% ($100 - \frac{15.56}{16.2} \times 100$). Decrease in completed work cost due to decrease in overhead expenditures is 0.64% ($\frac{16.2 \times 3.98}{100}$).

The total savings is made up of the savings for the individual expenditure items and should correspond to the sum which is stipulated in the construction cost decrease tasks. Calculation of total savings with ascertainment of the influence of cost change in the separate items on total savings can be illustrated with the following example, which includes figures for the first quarter of 1956:

Expenditure Items	Estimated cost in July 1 1955 prices in 1000 rubles	Planned Task for Cost Decrease in 1000 rubles	Planned Task for Cost Decrease in % of estimated cost	Planned Cost in 1000 rubles	Actual cost in 1000 rubles
Materials	7503	-143	-1.16	7360	7480
Basic Wages	1722	-78	-0.64	1644	1680
Expenditures for machinery operation	738	-38	-0.30	700	700
Other direct expenditures	369	-32	-0.26	337	330
Total Direct expenditures	10332	-291	-2.36	10041	10190
Overhead	1968	-78	-0.64	1890	1910
Total	12300	-369	-3.0	11931	12100

Expenditure Items	Savings (-) or Overexpenditure (+) In Comparison with Plan		In Comparison with Estimate	
	in 1000 rubles	in %	in 1000 rubles	in %
Materials	+120	+0.98	-23	-0.19
Basic Wages	+36	+0.31	-42	-0.34
Expenditures for Machine Operation	-	-	-38	-0.30
Other Direct expenditures	-7	-0.06	-39	-0.31
Total Direct Expenditures	+149	+1.23	-142	-1.14
Overhead expenditures	+20	+0.17	-58	-0.46
Total	+169	+1.40	-200	-1.

A construction cost decrease was provided for the first quarter of 1956 of 3% against the estimate, that is, 369,000 rubles. However, the plan for cost decrease was not fulfilled. The actual cost of completed work was 196,000 rubles (1.4%) higher than planned cost. The actual construction cost increase is only 1.6% (200,000 rubles). It follows that the actual construction cost decrease against the estimate (-1.6%) is formed of the percent of planned task for decrease in comparison with the estimate and the actual over-expenditure in comparison with the plan - 3 + 1.4 = - 1.6. The actual savings is obtained from the sum-total of planned savings and overexpenditure in comparison with the plan (-369 + 169 = -200). On the basis of the figures in the above table it is possible to establish also the porportionate weight of individual items in the total savings or overexpenditure, which can serve as a basis for making a detailed analysis for the expenditure items. Specialization of construction organizations as well as enlargement is quite significant in the matter of decreasing construction cost. Specialized and large organizations always have a greater potential for this than non-specialized or small organizations.

The formation of powerful territorial trusts in the country's larges cities is of great significance. For example, labor productivity on the construction projects of the main Moscow construction organization increased 31% during the first two years of its existence. Wide use is also being found for modern construction methods, the use

of prefabricated elements and structures, as a result of which building and other structure prefabrication has increased to 63% (from 41% in 1953). All of this has made it possible to decrease construction cost. Cost accounting is extremely important in the matter of assuring the principle of material interest on the part of the individual enterprises, organizations or collectives in the results of their work. The basic results characterizing the successful use of cost accounting as the most efficient method of keeping the budget are an improvement in product quality and cost decrease. The basic requirements for effecting cost accounting in construction are the following: timely supply to construction jobs of high quality and modern plan documentation, a construction-technological financial plan with the contractor organizations, observance of contract stipulations among individual organizations, timely calculation of the results of the operations of construction organizations and the correct organization of financing and checks. In observing these conditions and requirements cost accounting stimulates those construction organizations or individual collectives to seek more effective methods of using state funds and to become more and more self-supporting. Therefore, the incorporation and constant consolidation of cost accounting in construction in all of its links is the force which furthers not only decrease in construction cost but general improvement in construction.

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